MISHIMOTO

ENGINEERING REPORT

2015+ Ford F-150 EcoBoost Intercooler | SKU: MMINT-F150-15

By Jason Wettig, *Mishimoto Engineer*

REPORT AT A GLANCE

- **Goal:** Design a direct-fit intercooler that keeps charge-air temperatures and pressure drop across the core as low as possible.
- **Results:** The Mishimoto intercooler showed temperature drops of up to 10°F (5.5°C) when compared to the stock intercooler. This reduction was achieved with an overall pressure drop of less than 1.5 psi.
- **Conclusion:** The Mishimoto direct-fit intercooler is an excellent upgrade for F-150 owners who want a well-balanced intercooler in terms of performance and fitment.

CONTENTS

DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Design a performance intercooler that reduces charge-air temperatures when compared to the stock cooler.
- Must be a direct fit with no cutting or permanent modification necessary. Must retain stock grille shutters.
- Intercooler should not show a significant increase in pressure drop when compared to stock.

DESIGN AND FITMENTS

We began the R&D process by evaluating the stock intercooler and finding potential room for improvement. The stock intercooler is a relatively hollow tube-and-fin design. It mounts low on the front bumper and does not protrude to the top grille. The stock cooler also uses active grille shutters to increase or decrees flow over the intercooler during certain driving conditions. After evaluating the internal construction of the core, it was evident that this unit was susceptible to heat-soak. The Mishimoto performance intercooler was designed to increase overall core volume and fin surface area while retaining a direct fitment. As shown in Figures 1 and 2, the Mishimoto intercooler increases core volume by 77% and fin surface area by 163% when compared to stock

The F-150 is used for many purposes: off-road use, daily driving, as a work truck and tow vehicle. We wanted to offer an intercooler that would perform the best under all conditions. To achieve that, three cores would be specked out and tested. All the cores were bar-and-plate construction. The reason for bar-and-plate is increased strength is needed to live up to the extreme demands of these trucks. More information on the R&D process for the radiator can be found on the Mishimoto Engineering Blog here:

MISHIMOTO ENGINEERING BLOG

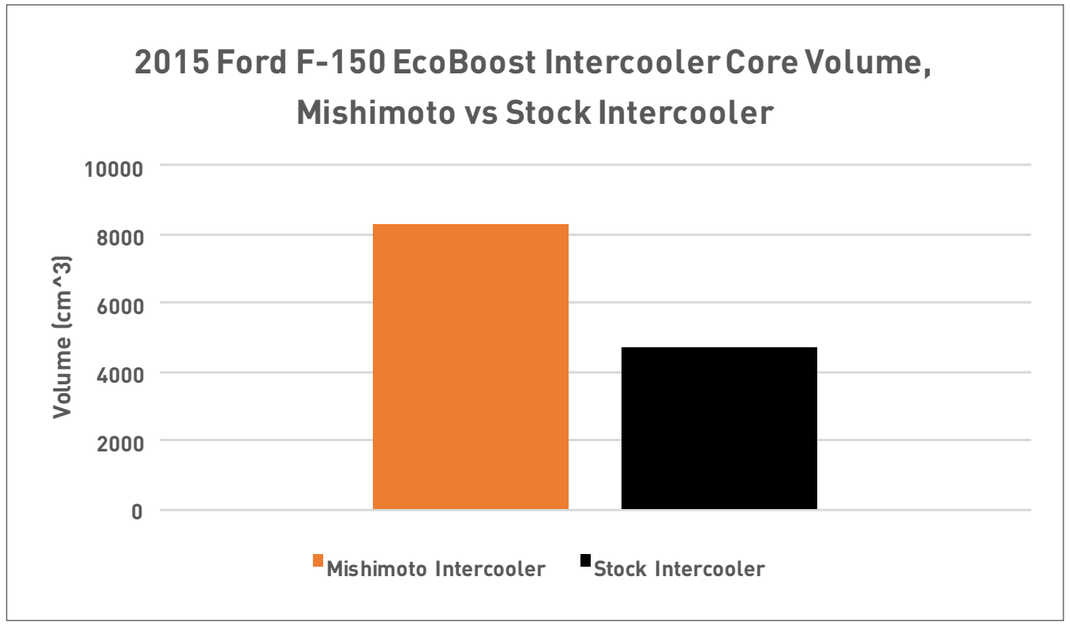

FIGURE 1: *The Mishimoto intercooler core is 77% larger than stock while maintaining a factory fit.*

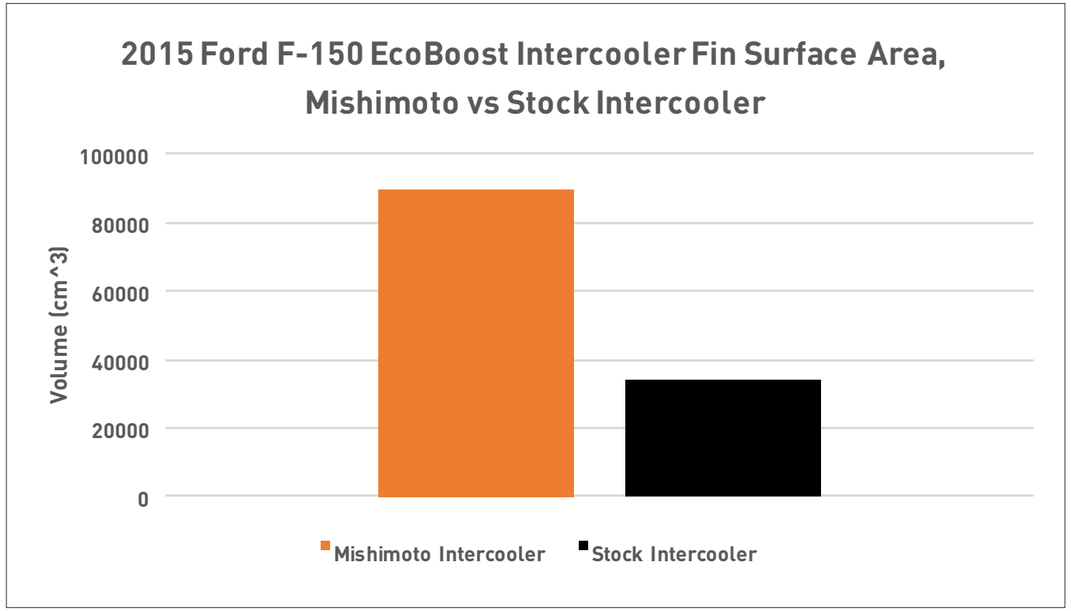

FIGURE 2: *By reducing fin height and pitch, the surface area was increased by 163% compared to the stock core.*

PERFORMANCE TESTING

A completely stock 2015 Ford F-150 2.7L EcoBoost was used for testing. The ambient temperature on the day of testing was approximately 72˚F (22.2˚C) with 29% humidity. To test the performance increases of the intercooler and heat soak, a Dynojet™ dynamometer was used to apply a constant and repeatable load on the F-150.

FIGURE 3: *A Dynojet™ dynamometer was used for vehicle testing.*

To test the performance gains as well as heat-soak of the Mishimoto intercooler, the F-150 was loaded onto the Dynojet, and baseline pulls were made of the completely stock car. These single pulls, while generating heat, did not demonstrate how an intercooler can heat-soak over time. A new test was designed to heat-soak the intercooler. With the truck on the dyno, four consecutive dyno pulls were performed in 3rd gear with a one-minute wait in-between each run. This allowed the intercooler to heat-soak, which more closely simulated real work conditions. Since tuning these trucks is a very popular option, the decision was made to perform the same test but with one change: the truck would be tuned. This generates more heat and boost, which intensifies the output of all the systems in the truck.

The testing results indicated that the Mishimoto intercooler outperformed the stock intercooler in terms of temperature drop and resistance to heat-soak. However, it showed a slight increase in pressure drop. To develop the most superior product possible, we also tested this with a tuned vehicle. Comparing the results with the stock car, the Mishimoto intercooler was able to handle the heat much better than the stock intercooler while keeping the pressure drop below 1.5 psi. Outlet temperatures were much more constant and very close to the ambient temperature. The results for temperature drops and pressure drops from testing on a stock tune can be seen in Figures 4–6 below.

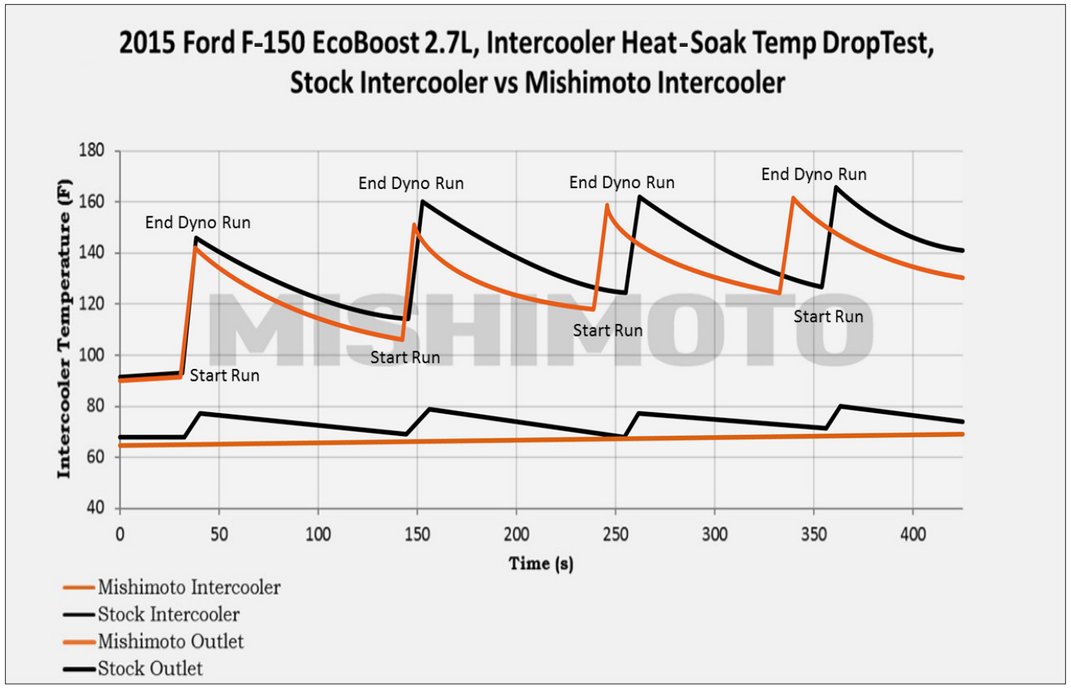

FIGURE 4: *This is the chosen Mishimoto Intercooler vs the Stock Intercooler. Notice how the Stock outlet rises during the dyno pull while the Mishimoto Intercooler does not.*

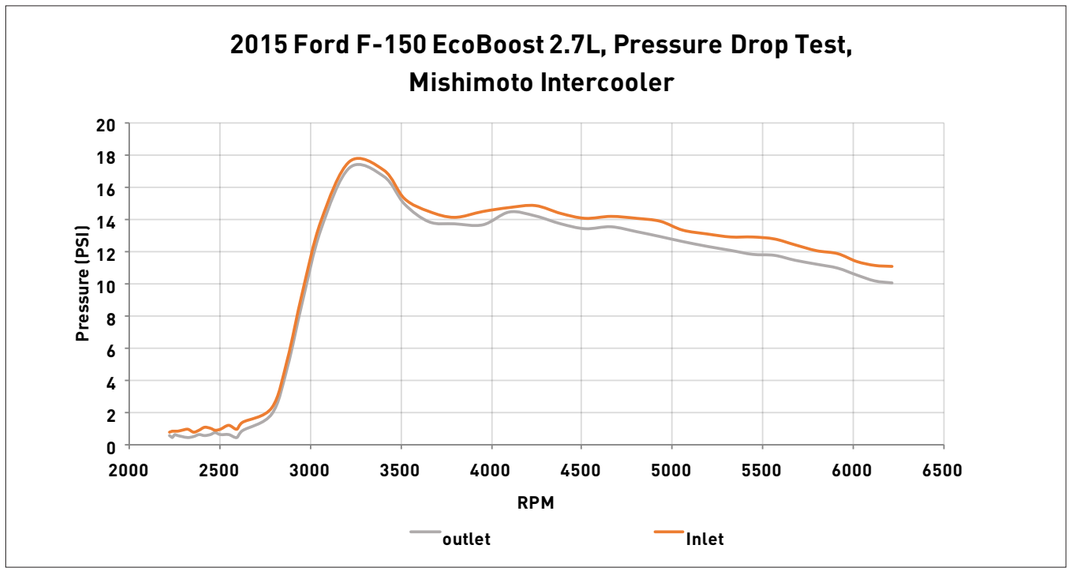

FIGURE 5: *Mishimoto Intercooler pressure drop across the intercooler during a dyno pull. At the end of the run there is about a 1 psi pressure drop.*

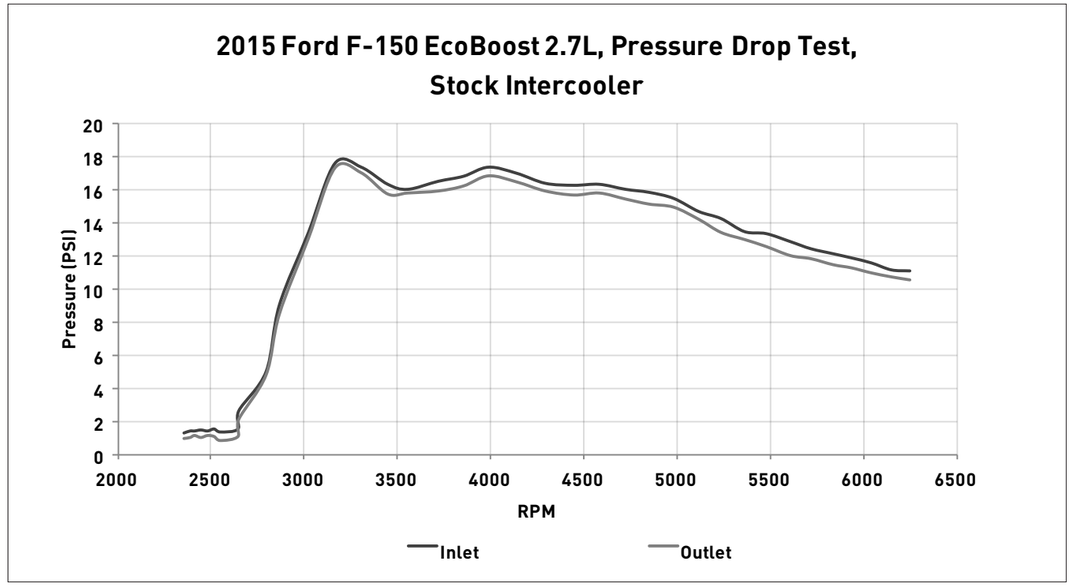

FIGURE 6: *Stock intercooler pressure drop across core. At the end of the run there is about .75 psi.*

The chosen core for the Mishimoto direct-fit intercooler was test core number 2.

This configuration showed temperature drops of up to 10°F (5.5°C) compared to the stock intercooler, while showing a greater resistance to heat-soak throughout the entire testing process. This was achieved with an increase of less than .25 psi (compared to stock) and an overall pressure drop of less than 1.5 psi.

As is the case with many intercoolers, power levels did not show any appreciable gains on a completely stock tune. An intercooler's primary function is to keep charge-air temperatures low. If the air temperature entering the engine begins to climb, the ECU will reduce power to preserve engine longevity. This can have a large impact on the available power during high-load events such as towing. A performance intercooler will aid in preventing this loss of power on a completely stock tune. If an aftermarket tune is being loaded onto the vehicle, additional gains can be expected because the tuner is able to compensate for the reduction in engine air temperature as well as the increased volume

Jason Wettig
Product Engineer, Mishimoto Automotive

FOLLOW US

Mishimoto is very active on social media so we can be in constant contact with our customers. Our Social Media Team is available via Facebook, Instagram, Twitter, YouTube, Google+, our Engineering Blog, and forums. We sponsor contests and promotional events, so be sure to follow us.

GoMishimoto

#Mishimoto

Mishimoto

+Mishimoto

Mishim0t0

Engineering.
Mishimoto.com

CONTACT US

EMAIL
For sales and technical questions please contact
support@mishimoto.com

BY PHONE
USA: 877.466.4744
International: +1.302.762.4501
Fax: 302.762.4503

MAIL
Mishimoto
18 Boulden Circle, Suite 10
New Castle, DE 19720

VISIT
Mishimoto.com
Mishimoto.co.uk
Mishimoto.eu

MISHIMOTO